UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

PC Code: 099100
DP Barcode: 380651 (Parent)
385629 (Sub-bean)
Decision: 432361

MEMORANDUM

DATE: February 22, 2011

SUBJECT: Studies for the Application of Registration of the New Encapsulated Formulation Containing Pyraclostrobin Bas 500 20 F Fungicide

FROM: Robert Miller, Environmental Protection Specialist
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Environmental Fate and Effects Division (7507P)

TO: Tony Kish, Risk Manager
Registration Support Branch
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Attached Are the Requested Studies for the Application of Registration of the New Encapsulated Formulation Containing Pyraclostrobin BAS 500 20 F Fungicide

Below is a list of the attached studies:

Table 1. Submitted Environmental Fate Studies for the Application of Registration of BAS 500 20 F Fungicide.

Study Type	Study Classification	MRID
Minor Change Reasoning	No Classification[1]	48037306
Wash-off of Encapsulated Pyraclostrobin (BAS 500 F) from Corn Plants	Ancillary	48037313
Comparison of Pyraclostrobin (BAS 500 F) Field Soil Dissipation Endpoints from North American Trials with EC, WG, and CS Formulations	Ancillary	48037314

[1]This study is not relevant to EFED.

Data Evaluation on the Wash-off of Encapsulated Pyraclostrobin (BAS 500 F) from Corn Plants

EPA PC Code: 099100

EPA DP Barcode: Parent: 380651; Sub-bean: 385629

EPA Guideline: Non-Guideline MRID: 48037313

Test Material: Pyraclostrobin

Date of Review: February 22, 2011

Reviewer: Robert A. Miller, Environmental Protection Specialist

Classification: This study provides ancillary information.

Purpose of Review: The purpose of this non-guideline study is to estimate the wash-off behavior of encapsulated pyraclostrobin, BAS 500 F, from corn leaves 1) without adjuvants under four levels of irrigation and 2) with adjuvants under highest level of irrigation.

Materials and Methods

Test Materials: Pyraclostrobin

Selected Characteristics of test substances used in this study are described below in **Table 1**:

Table 1. Characteristics of Test Substances	
BAS Number:	BAS 500 18 (CS) and BAS 20 F (CS)
Lot Numbers:	385055 and a 385074
Physical State:	Capsule Suspension
Storage:	Ambient Conditions
Active Ingredient:	BAS 500 F
Percentage of Active Ingredient:	250 g a.i./L
Chemical Abstracts Name:	Mehthyl-N[[[1-(4-chlorophenyl)pyrazole-3-yl]oxy]-o-toly]-N-methocarbamate
CAS Number:	175013-18-0
Molecular Formula:	$C_{19}H_{18}ClN_3O_4$
Molecular Weight:	387.83 g/mol
Solubility in Water:	2.41 mg/L

Methods

Target Application Rate and Treatments

The target rate for both BAS 500 18 F and BAS 500 20 F (encapsulated) products was 6 fluid ounces per acre applied in a total volume of 10 gallons per acre using water as the carrier. There

were 4 treatments using 6 plants per treatment. Each treatment was calculated to require a spray volume of 6.81 mL to be delivered to 8.35 square feet. The concentration of the BAS 500 18 F in the total spray volume was 0.59 mL per 120 mL spray solution.

Calibration of Auto Sprayer

The auto sprayer was calibrated for a target of 10 gallons per acre (GPA) of spray solution. This sprayer uses a moving nozzle to mimic a tractor mounted boom sprayer. The sprayer setup details are listed below:.

Nozzle: TeeJet 8001E even flat fan nozzle
Pressure: 43 psi at nozzle
Speed: 3.55 mph
Spray swath at crop canopy height: 20 inches
Nozzle height above canopy: 20 inches

The sprayer was calibrated by spraying 3.5 inch diameter glass petri plates and weighing the amount of spray deposited on the plate. At 10 GPA the amount that should be captured is 0.0581g. Ten plates were used to cover the treatment area and averaged 0.055g per plate. This calculates to 9.5 GPA. Spray application amounts were calculated using 9.5 GPA.

The area to be sprayed was 20 inches wide by 5 feet long or 8.35 square feet or 0.00019 acre. At 9.5 GPA, the amount of spray should be 6.81 mL per 8.35 square feet. This area of 8.35 square feet will accommodate the spacing of 6 corn plants that is equal to a field plant population of 31,301 plants per acre. This population is not uncommon in the Midwest US.

The sprayer was calibrated for both experiments (Experiment #1 and Experiment #2, listed below). The parameters settings were exactly the same for both calibrations except that only 4 petri dishes were used in the second calibration instead of 10 used in the first calibration. Both calibrations were set for 10 gallons per acre (GPA). The first and second calibrations achieved GPAs 9.5 and 10 respectively.

The sprayer was flushed with fresh water between each spray event to eliminate carry over.

Test System

Experiment 1:

The purpose of this experiment is to estimate the wash-off behavior of encapsulated pyraclostrobin from corn leaves without adjuvants under four levels of irrigation (0.0, 0.1, 0.25, and 0.5 inches). The intended commercial formulation is BAS 500 20 F. However, this experiment investigated the behavior of the pre-cursor formulation, BAS 500 18 F. BASF Registration Document No. 2010/1036109 (MRID 48037306) provides a comparison of the components of BAS 500 18 F and BAS 500 20 F. The target amount of the active ingredient is the same in both formulations with minor variation in the contents of some inerts.

Corn plants were grown to the growth stage V5-V6 in a greenhouse and treated with BAS 500 18 F without adjuvants in a spray chamber. There were five treatment groups of 6 plants. The treated plants were then subjected to simulated rainfall using the rainfall simulator function of

the spray chamber. The target rate for BAS 500 18 F was 6 fluid ounces a.i./A in a total volume of 10 Gal/A of water as the carrier for each treatment group. Each treatment was a spray volume of 6.81 mL sprayed to an area of 8.35 sq. feet. The concentration of BAS 500 18 F in the spray volume was 0.59 mL per 120 mL spray solution. After being sprayed the corn plants were allowed to dry for 2 hours.

Two hours after application of pyraclostrobin overhead irrigation was applied to treated plants via the rainfall simulator inside the spray chamber. A rain gauge was placed in the chamber to determine the amount of sprinkler irrigation that had been applied. The length of time required to accumulate 0.1, 0.25, and 0.5 inches of rain was recorded. The evaluation consisted of the following treatments:

Treatment 1) Plants (minimum of 5) sampled prior to the application of pyraclostrobin to establish a baseline level for evaluation.

Treatment 2) Plants (minimum of 5) sampled immediately after the application of pyraclostrobin to establish an initial level of pyraclostrobin prior to the application of precipitation.

Treatment 3) Plants (minimum of 5) and samples collected after 0.1 in. of simulated rainfall has occurred.

Treatment 4) Plants (minimum of 5) and samples collected after 0.25 in. of simulated rainfall has occurred.

Treatment 5) Plants (minimum of 5) and samples collected after 0.50 in. of simulated rainfall has occurred.

Plant and water samples were collected for analysis of pyraclostrobin content. Plot samples consisted of whole corn plants cut off at soil surface and composited within each treatment for grinding and tissue analysis. All water washing through the plant canopy for each treatment was collected in trays placed beneath the canopy for analysis.

Experiment 2:

The purpose of this experiment was to estimate the wash-off behavior of encapsulated pyraclostrobin from corn leaves with adjuvants under highest level of irrigation (0.5 inches). Experiment 2 was set-up exactly the same as Experiment 1. For each treatment group the test substance BAS 500 20 F was measured into aliquots and were diluted and assayed. Three adjuvants were used in this test. Each adjuvant was added to one of the aliquots for a total of four spray solutions:

Spray Solution # 1: BAS 500 20 F 6 fl oz/acre (stock solution), no adjuvant

Spray Solution # 2: BAS 500 20 F 6 fl oz/acre + Induce 0.125% v/v (0.125mL/100mL)

Spray Solution # 3: BAS 500 20 F 6 fl oz/acre + Agridex 0.5% v/v (0.5mL/100mL)

Spray Solution # 4: BAS 500 20 F 6 fl oz/acre + Sun-it II 16 fl oz/A 0.5% (1.25mL/100mL)

There were 4 treatment groups each involving 6 plants. An additional six plants were left untreated and were used as a control group during analysis. A 20 mL aliquot of each spray solution was used to treat the plants for each treatment group. Each treatment group was allowed to dry for two hours after application. The treatment group details

Treatment Group #1: 6 fl oz a.i/A, spray solution #1, 30 minute simulated rainfall (approximately 0.5 in).

Treatment Group #2: 6 fl oz a.i/A, spray solution #2, 30 minute simulated rainfall (approximately 0.5 in).

Treatment Group #3: 6 fl oz a.i/A, spray solution #3, 30 minute simulated rainfall (approximately 0.5 in).

Treatment Group #4: 6 fl oz a.i/A, spray solution #4, 30 minute simulated rainfall (approximately 0.5 in).

The treatments for both experiments are summarized in **Table 2**.

Table 2. Application and Wash-off Rates for Experiments 1 and 2

Experiment Identifaction	Formulation	Treatment Number	Rate (oz/A)	Adjuvant	Simulated Rainfall (inch)
Experiment 1	BAS 500 18 F	1	6	None	0
		2	6	None	0.5
		3	6	None	0.25
		4	6	None	0.1
Experiment 2	BAS 500 20 F	1	6	None	0.5
		2	6	Induce 0.125%v/v	0.5
		3	6	Agridex 0.5%	0.5

				v/v	
		4	6	SunIt II 16 oz/A	0.5

Analytical Method (LC/MS/MS Method)

Descriptions of samples preparation can be found in the materials and methods section. Samples were analyzed by LC/MS/MS. The analytical parameters are listed in the tables given in Section 3.7.2.1 of the MRID #**48037313**.

Results and Discussion:

BAS 500 18 F and BAS 500 20 F are the practically the same in concentration of the active ingredient (250 g a.i./L). The only difference between the two formulations is a slight a variation in the inert ingredients of the capsules. From Experiment 1, the wash-off potential of BAS 500 18 F with varying amounts of rainfall is shown **Table 3**. The highest per cent active ingredient wash-off was 31% for 0.25 inches of rainfall simulation. Wash-off for 0.5 inches of simulated rainfall was 25.5% and for 0.1 inches of simulated precipitation 9.9%. The simulated 0.5 inch rain, which came to approximately 0.63 inches, was intended to represent severe rain event such as a thunderstorm.

Table 3. Quantitative Distribution of BAS 500 F Remaining in Corn and Wash-off Water after Treatment with BAS 500 18 F without Adjuvants by Simulated Rain Events

Sample Name	Weight of Water Wash (g)	Amount of AI in Wash (µg)	BAS 500 F in Water Wash[1] (ppm)	Weight of Corn (g)	Amount of AI in Corn (µg)	BAS 500 F in Corn[2] (ppm)	% AI in Water	% AI in Corn
No Rain Event	N/A	N/A	N/A	814	2377	2.92	N/A	100.0
0.1" Rain Event	1840	327.5	0.178	988	2984	3.02	9.89	90.11
0.25" Rain Event	6550	943.2	0.144	937	2052	2.19	31.49	68.51
0.5" Rain Event	13000	1053	0.081	1109	3072	2.77	25.53	74.47

[1] ppm in water wash = avg. of 3 reps. (ng/ml from LC//MS/MS results) X 10 (dilution factor) X 1 µg/1000 ng X final volume (ml)/weight of water wash (g)

[2] ppm in corn = avg. of 3 reps. (ng/ml from LC//MS/MS results) X 10 ml final volume X (dilution factor, partition) X 100 (dilution factor, extraction) X µg/1000 ng/avg of 3 reps (measured sample weight, g).

The wash-off characteristics of BAS 500 20 F and three adjuvants were investigated during 0.5 of simulated rainfall in Experiment 2. The results of the adjuvant wash-off experiment are listed

in **Table 2**. BAS 500 20 F resulted in slightly less wash-off from the surface of corn plants (~ 7%) whereas the adjuvants resulted in a slightly higher wash-off range between 8 and 12%).

Table 2. Quantitative Distribution of BAS 500 F Remaining in Corn plants and Wash-off Water after Treatment with BAS 500 F 20 F with Adjuvants by Simulated Rain Events

Sample Name	Weight of Water Wash (g)	Amount of AI in Wash (µg)	BAS 500 F in Water Wash[1] (ppm)	Weight of Corn (g)	Amount of AI in Corn (µg)	BAS 500 F in Corn[2] (ppm)	% AI in Water	% AI in Corn
Untreated Control	N/A	N/A	N/A	882	0	0.00	N/A	N/A
Treatment 2	11080	202	0.018	1108	2764	2.495	6.81	93.2
Treatment 3	10840	236	0.022	1077	2730	2.535	7.96	92.0
Treatment 4	11400	271	0.024	1255	2073	1.652	11.56	88.4
Treatment 5	10440	214	0.020	1056	2383	2.257	8.24	91.8

[1] ppm in water wash = avg. of 3 reps. (ng/ml from LC//MS/MS results) X 10 (dilution factor) X 1 µg/1000 ng X final volume (ml)/weight of water wash (g)

[2] ppm in corn = avg. of 3 reps. (ng/ml from LC//MS/MS results) X 10 ml final volume X (dilution factor, partition) X 100 (dilution factor, extraction) X µg/1000 ng/avg of 3 reps (measured sample weight, g).

Conclusion:

The results of these experiments show that canopy retention is expected to be an important factor in reducing the loading of pyraclostrobin to soil when applied during the V5-V6 stage. This is a non-guideline study and provides supplemental information.

CITATION: Singh, M. 2010. The Wash-off of Encapsulated Pyraclostrobin (BAS 500 F) from Corn Plants. BASF Registration Document No. 2010/7008264.

Comparison of pyraclostrobin (BAS 500 F) Field Soil Dissipation Endpoints from North American Trials with EC, WG AND CS Formulations

EPA PC Code: 099100

EPA DP Barcode: Parent: 380651; Sub-bean: 385629

EPA Guideline: Non-Guideline MRID: 48037314

Test Material: Pyraclostrobin

Date of Review: February 22, 2011

Reviewer: Robert A. Miller, Environmental Protection Specialist

Classification: This study provides ancillary information.

Purpose of Review: The purpose of this non-guideline study is to investigate if formulation type has any significant influence on the dissipation behavior of pyraclostrobin under field conditions.

Methodology:

The field soil dissipation of pyraclostrobin (BAS 500 F) was evaluated in 9 North American studies encompassing 24 trials between 1998 through 2001. Eighteen trials were conducted using an emulsifiable concentrate (EC) while 6 trials were conducted using a wettable granule (WG). In 2009 a study was initiated to evaluate the capsule suspension (CS) in two field trials. This study is on-going. The Gustafson-Holden bi-phasic kinetic model was used for was used for all data sets. The DT_{50} and DT_{75} of pyraclostrobin soil residue following the last application were compared using a single factor analysis of variance (ANOVA) among the 3 formulations.

Results and Discussion:

As expected, despite formulation type, trials with lower average air temperature and lower water inputs were generally associated with longer DT_{50} and DT_{75} values. Pyraclostrobin and metabolites are strongly bound to soil and have organic carbon normalized soil adsorption coefficients (Koc_{ads}) ranging from approximately 1000 mL/g for metabolite BF 500-5 to more than 10,000 mL/g for metabolite BF 500-6.

The EC, WG and CS formulation trial DT_{50} and $DT7_5$ values are listed in **Tables 1** and **2**, respectively. Based on a single factor analysis of variance (ANOVA) there was no significant differences in the DT_{50} between the formulation types (P=0.591) (**Figure 1**) and in DT_{75} between the formulation types (P=0.590) (**Figure 2**).

Table 1. Pyraclostrobin Kinetic DT_{50} Endpoints					
EC		**WG**		**CS**	
NJ	7.1	ND	11.3	IL	13.9

NJ	19	CA	14.7	ND	14.1
IN	55.1	CA	25.4		
IN	38.9	CA	14.7		
CA	19	FL	24.4		
CA	23.4	FL	19		
NY	31				
CA	21				
NC	15				
TX	11.5				
SD	12.9				
NJ	6.4				
ONT	11.7				
ALB	23.3				
MAN	38.4				
PEI	90				
ND	11				
CA	11.7				

Figure 1. ANOVA: Single Factor for Pyraclostrobin Kinetic DT_{50} Endpoints

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
EC	18	446.4	24.8	428.0776
WG	6	109.5	18.25	32.603
CS	2	28	14	0.02

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	348.0485	2	174.0242	0.537952	0.591112	3.422132
Within Groups	7440.355	23	323.4937			
Total	7788.403	25				

Table 2. Pyraclostrobin Kinetic DT_{75} Endpoints					
EC		**WG**		**CS**	
NJ	23.4	ND	42	IL	29
NJ	53.6	CA	31.8	ND	190.5
IN	119.3	CA	57.4		
IN	84	CA	103.9		
CA	44.7	FL	68.1		
CA	50.2	FL	59.1		
NY	74.1				
CA	73.7				
NC	44.2				
TX	30.5				
SD	33.5				
NJ	16.1				

ONT	39.6				
ALB	139.2				
MAN	232.7				
PEI	190.7				
ND	41				
CA	29.2				

Figure 2. ANOVA: Single Factor for Pyraclostrobin Kinetic DT_{75} Endpoints

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
EC	18	446.4	24.8	428.0776
WG	6	109.5	18.25	32.603
CS	2	28	14	0.02

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	348.0485	2	174.0242	0.537952	0.591112	3.422132
Within Groups	7440.355	23	323.4937			
Total	7788.403	25				

Conclusion

Formulation type is not an important factor in influencing the field dissipation behavior as temperature and moisture. Based on field dissipation data, there is no significant difference ($P > 0.05$) in the dissipation kinetics of pyraclostrobin due to formulation type.